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"TACTICAL AIRLIFT

AUTOMATION DEVELOPMENT/TESTBED EXPERIMENTATION"

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The Air Force Electronic Systems Division (ESD) and the MITRE Corporation have been addressing the problems of tactical airlift command and control for several years as part of a larger concern for the development of automation support to the deployed Air Force Tactical Air Control System (TACS). In 1966-67, an effort to investigate the feasibility and desirability of utilizing automatic data processing (ADP) equipment to improve the effectiveness of the Airlift Control Center (ALCC) resulted in the development of an ALCC simulation center. This center was based upon use of teletype terminals connected to a remote digital computer. In addition, during 1967 ESD and MITRE personnel had an opportunity to participate in a Southeast Asia study effort as members of an Air Force Technical Assistance Team. One of the team tasks was to study the Airlift Control Center at Tan Son Nhut. This study provided extensive information on airlift operations in Southeast Asia.

In 1968, the development of the Tactical Data Systems Development Testbed (TDSDT) at L. G. Hanscom Field made it possible to greatly extend the scope of tactical airlift efforts. The testbed, which was designed to permit the evaluation of alternative approaches to tactical data automation, consists of a highly flexible network of computers, digital communications, and display-oriented operator stations. The testbed is centered about a medium scale computer that is digitally connected to a network of mini-computers. The mini-computers in turn service the individual operator stations. In the testbed, the central computer provides random access storage for operational data files under the control of software that provides a time-shared executive system, a general purpose data management system, and operations-specific application computer programs. The testbed makes use of distributed data processing in that specific processing tasks are executed whenever possible by the mini-computers at the periphery of the system. At present, the testbed includes two operations centers. Each center consists of three operator stations and an associated mini-computer. An individual operator station includes a cathode ray tube for the display of alphanumeric information, a keyboard and display controls, a hard-copy printer, and an incremental tape recorder. In addition, a set of switches permit the operator to transfer information between the devices at his own station, to other operator stations, and to the central computer.

A mobile operator station, called the Tactical Data Source Automation Module (TDSAM) has been developed and mounted in a self-propelled van. The TDSAM contains a single operator station and an associated mini-computer. Communication with the central computer is provided by voice grade commercial telephone lines. Since the TDSAM provides its own power and air conditioning, the availability of a telephone line becomes the only limiting factor in its deployment. We hope to be able to install radio equipments in the future to remove this constraint. The availability of the TDSAM has given us an opportunity to explore some of the implications of source data automation. Perhaps even more important, it has given us the opportunity to take our testbed work directly to the experienced user and engage the user in a head-to-head discussion on the pros and cons of the approaches to tactical automation that are being evaluated in the testbed.

As part of an overall effort to explore approaches to providing automation support to the Air Force Tactical Air Control Center (TACC), we have implemented an experimental tactical airlift capability in the testbed. The design of our software has been largely based upon an analysis of tactical doctrine and data and procedures applicable to current operations in Southeast Asia. The basic approach has been to provide automation support in the form of software "tools" designed to assist the duty officer in the execution of his assigned responsibilities. The duty officer is our intended user. We are very much user oriented and have a strong concern that the automation capabilities that we provide have a definite operational utility. We have been very cautious in applying automation to tactical airlift management tasks and have only provided automation support in those functional areas that we felt would yield the highest payoff to the duty officer and the greatest operational utility.

At present, we have implemented a representative capability in the testbed to support the duty officer in the conduct of current operations. This includes the monitoring and adjustment of today's airlift missions. By doing the detailed bookkeeping required to maintain a near-real-time status of all the elements of the airlift system, the software can provide the duty officer with a variety of concise displays which accurately reflect the status of forces. Similarly, by maintaining the status of all requests, port cargo and mission schedules, we can provide the duty officer with convenient ways to

answer the "Where is it?" and "When will it get here?" type of questions. A series of software monitoring tools has also been developed to alert the duty officer when real world events deviate from the plan.

In addition to the monitoring function, the duty officers must be provided with convenient ways to make adjustments to airlift operations in response to changing conditions such as unscheduled aircraft maintenance, weather conditions, receipt of emergency airlift requests, or the closing of an airbase due to enemy action. We have provided the duty officer with software tools to help him determine the impact of changes in the tactical environment. The duty officer can also implement changes in mission itineraries and cargo assignment and make repetitive trial changes to airlift missions to determine the kind of adjustment that best meets his requirements.

Another major part of our airlift effort is the development of automation support to the current plans function. The software is designed to support the current plans duty officer in the preparation of a plan, or frag order, for tomorrow's operation. The basic approach is to provide the duty officer with interactive software tools that will accomplish the processing associated with the matching of requirements and resources. The decisions with regard to what alternatives to select or which strategy to employ is left in the capable hands of the duty officer. The current plans duty officer is continually confronted with a series of questions or choices and his decisions determine the actual processing that follows.

In addition to providing a vehicle for implementing our experimental airlift capability, the testbed provides a means to test our concepts and experimental software. In our airlift testing, we have made extensive use of tactical airlift data from Southeast Asia. Although this data may be atypical, and not wholly representative of the generalized tactical environment, the data is real and gives us a unique opportunity to measure concepts against fact. We have compiled a data base which consists of one day's actual Southeast Asia airlift operation. Through use of the testbed as a simulated Airlift Control Center, we are able to determine the operational utility of various levels of automation support and contrast the results obtained through the use of automation with those obtained from strictly manual procedures.

The difficulty of creating a complete and credible environment, however, has constrained our formal testing efforts and we have achieved higher payoff, in terms of improvements to our concepts

and airlift software, from the more informal testing we have been able to accomplish. This informal testing has consisted largely in getting experienced airlift officers involved in the use and operation of our experimental software. In this way, the officer can tell us specifically what he thinks the system does well and where he thinks it needs improvement or extension. The TDSAM has given us the added capability to take the system to the user for his evaluation. For example, we are able to take the TDSAM to the Tactical Airlift Symposium at Pope Air Force Base. Many design changes and improvements have resulted from the specific comments made by the large group of highly experienced airlifters attending the symposium. The availability of our experimental system provides a vehicle for the meaningful discussion of requirements between users and system designers.

Although any attempt to draw definitive conclusions from the work accomplished to date may be premature, we have learned a great deal about airlift operations and automation of airlift management functions through the design, implementation and testing of the experimental capability in the testbed. Most important, we are convinced that it is both feasible and operationally desirable to provide automation support to tactical airlift. We further believe that automation support to tactical airlift can be provided as a compatible part of larger automation support for the overall requirements for tactical command and control. We think that the requirements of tactical airlift can best be served by providing automation support to the airlift duty officers rather than by attempting to automate the entire airlift function. We believe that airlift automation support must be user oriented - simple to use and capable of interfacing with the duty officer in his terms to ensure manual compatibility and to minimize training requirements.

In conclusion, let me say that we are convinced of the validity of the testbed approach in the development of automation to support operational functions. In spite of our best efforts and intentions, we have made mistakes and some bad design decisions in the testbed. Although it was painful in some cases to reorient our thinking and begin again, we could at least take comfort in the fact that we were learning in the testbed rather than during the expensive long-term acquisition of an operational system. The end result of our effort will be the production of specifications and engineering data to support the acquisition of an operational system. Because of our first-hand testbed experience, we are in a much better position to produce specifications for a system that is both feasible and responsive to the user requirement.

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13. ABSTRACT

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